Amendments to the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1. (*original*) In a digital device, a method of generating an output signal that represents a polar angle φ for a complex input signal, the method comprising the steps of:

(1) receiving the complex input signal having a real X_0 component and an imaginary Y_0 component;

(2) determining an angle φ_1 that is a coarse approximation to the angle φ, including the steps of

(2a) determining a Z_0 value that approximates a $[1/X_0]$ value, wherein $[X_0]$ is a truncated approximation of said X_0 component,

(2b) digitally multiplying said Z_0 value by Y_0, resulting in a $[Y_0 Z_0]$ value, and

(2c) determining an arctan of said $[Y_0Z_0]$ value, resulting in said angle φ_1;

(3) determining a fine adjustment angle φ_2, including the steps of

(3a) digitally computing an intermediate complex number, based on said $[Y_0/X_0]$ value, said intermediate complex number having a real X_1 component and an imaginary Y_1 component,

(3b) determining a Z_1 that approximates a $[1/X_1]$ value, wherein $[X_1]$ is a truncated approximation of said X_1 component,

(3c) digitally multiplying said X_1 component by said $[Z_1]$ value to produce a Z_1X_1 component, and digitally multiplying said Y_1 component by said $[Z_1]$ component to produce a Z_1Y_1 component,

(3d) determining a one's complement of said Z_1X_1 component, and

(3e) digitally multiplying said two's complement of said Z_1X_1 component by said Z_1Y_1 component, resulting in said fine adjustment angle φ_2; and

(4) adding said fine adjustment angle φ_2 to said angle φ_1 to form said output signal that is data used by said digital device.

2. (*original*) The method of claim 1, wherein step (2a) comprises the step of retrieving said [Z_0] value from a memory device.

3. (*original*) The method of claim 1, wherein step (2c) comprises the step of retrieving said angle φ_1 value from a memory device.

4. (*original*) The method of claim 1, wherein step (3b) comprises the step of retrieving said [Z_1] value from a memory device.

5. (*original*) The method of claim 1, wherein step (2a) comprises the step of retrieving said [Z_0] value from a memory device, and wherein step (3b) comprises the step of retrieving said [Z_1] value from said memory device.

6. (*original*) The method of claim 1, wherein said step (3a) comprises the step of multiplying said X_0 component and said Y_0 component by a tan φ_1.

7. (*original*) The method of claim 1, wherein said step (3a) comprises the step of multiplying said X_0 component and said Y_0 component by said [Z_0Y_0] value.

8. (*original*) An apparatus that generates an output signal that represents a polar angle φ for a complex input signal having a X_0 component and a Y_0 component, comprising:

a first memory that stores one or more Z_0 values indexed by $[X_0]$, wherein $[X_0]$ is a bit truncated version of said X_0 value, wherein said Z_0 value is approximately $1/[X_0]$;

a multiplier that multiplies said Z_0 value by the Y_0 component, resulting in a $[Z_0Y_0]$ value;

a second memory that stores one or more φ_1 angles, wherein said φ_1 angle is approximately an arctan of $[Z_0Y_0]$;

a digital circuit that multiples said X_0 component and said Y_0 component by said $[Z_0Y_0]$ value, resulting in an intermediate complex number having an X_1 component and a Y_1 component;

a fine angle computation stage that determines an angle φ_2 based on Y_1/X_1; and

an adder that adds $\varphi_1 + \varphi_2$ to produce said angle φ to form the output signal that is data processed by said apparatus.

9. (*original*) The apparatus of claim 8, wherein said fine angle computation stage includes:

a set of multipliers that multiply said X_1 component and said Y_1 component by a Z_1 value resulting in a X_1Z_1 component and a Y_1Z_1 component, wherein Z_1 is a bit truncated version of $1/[X_1]$, and wherein $[X_1]$ is a bit truncated version of X_1.

10. (*original*) The apparatus of claim 9, wherein said Z_1 value is retrieved from said first memory based on said $[X_1]$ value.

11. (*original*) The apparatus of claim 9, wherein said fine angle computation stage further includes:

a means for implementing a one's complement of said X_1Z_1; and

a second multiplier for multiplying said one's complement of X_1Z_1 by said Y_1Z_1 component.

12. (*original*) The apparatus of claim 9, wherein said fine angle computation stage further includes:

a means for implementing a two's complement of said X_1Z_1; and

a second multiplier for multiplying said two's complement of X_1Z_1 by said Y_1Z_1 component.

13. (*original*) The apparatus of claim 8, further comprising:

a scaling shifter, coupled to said digital circuit, wherein said scaling shifter scales said X_1 component in accordance with reciprocal values that are stored in said first memory.

14. (*original*) The apparatus of claim 13, wherein said scaling shifter also scales said Y_1 component similar to said scaling of said X_1 component.

15. *(original)* The apparatus of claim 8, wherein said digital circuit is a butterfly circuit that is coupled to an output of said multiplier.

16. *(original)* In a digital device, a method of generating an output signal that represents a polar angle φ for a complex input signal, the method comprising the steps of:

(1) receiving the complex input signal having a real X_0 component and an imaginary Y_0 component;

(2) retrieving a Z_0 value from a first memory, wherein Z_0 is a bit truncated approximation for $1/X_0$;

(3) digitally multiplying said Z_0 value by said Y_0 component, resulting in a $[Y_0Z_0]$ value;

(4) retrieving an angle φ_1 from a second memory, wherein φ_1 is based on an arctan of said $[Y_0Z_0]$ value;

(5) digitally rotating said input complex signal in a complex plane by said angle φ_1 to produce an intermediate complex signal having an X_1 component and a Y_1 component;

(6) digitally computing an angle φ_2 that is an approximation to an arctan Y_1/X_1; and

(7) adding said angle φ_2 to said angle φ_1 to form the output signal that is data used by said digital device.

17. *(original)* The method of claim 16, wherein said step (6) comprises step of:

(a) retrieving a Z_1 value from said first memory, wherein said Z_1 value is a bit truncated approximation of $1/X_1$; and

(b) digitally multiplying said X_1 component by said Z_1 value to produce a Z_1X_1 component, and digitally multiplying said Y_1 component by said Z_1 value to produce a Z_1Y_1 component;

(c) determining a one's complement of said Z_1X_1 component; and

(d) multiplying said one's complement of said Z_1X_1 component by said Z_1Y_1 component.

18. (*original*) The method of claim 16, wherein step (5) comprises the step of multiplying said input complex signal by a tan φ_1.

19. (*original*) The method of claim 16, wherein step (5) comprises the step of multiplying said input complex signal by said $[Y_0Z_0]$ value.

20 - 31 (*cancelled*)

32. (*currently amended*) In a digital device for generating an output signal that represents a polar angle φ for a complex input digital signal, a method of converting Cartesian data of said input digital signal to polar angle data of said output signal, comprising the steps of:

(1) receiving the input digital signal; and

(2) determining at least two subangles, the combination of which subangles represents the polar angle φ, wherein at least one subangle is determined by using a single trigonometric function of a subangle as an approximation for the subangle.

33. (*original*) The method of claim 32, wherein step (2) comprises the step of:

(a) determining at least one subangle by using a memory device.

34. (*currently amended*) The method of claim 32, wherein ~~said step (2) comprises the step of:~~

~~(a) determining~~ said at least one subangle is determined by using ~~a trigonometric function~~ the tangent of said ~~a~~ subangle as an approximation for said ~~the~~ subangle.

35. (*currently amended*) ~~The method of claim 34~~ In a digital device for generating an output signal that represents a polar angle φ for a complex input digital signal, a method of converting Cartesian data of said input digital signal to polar angle data of said output signal, comprising the steps of:

(1) receiving the input digital signal; and

(2) determining at least two subangles, the combination of which subangles represents the polar angle φ, wherein at least one subangle is determined by using a trigonometric function of a subangle as an approximation for the subangle,

~~wherein said step (a) comprises of the step of:~~

~~(i) determining~~ and said trigonometric function is determined using a previously determined subangle and said Cartesian data of said input digital signal.

36. (*original*) The method of claim 35, wherein said step ~~(i)~~ of determining said trigonometric function using a previously determined subangle and said Cartesian data of said input digital signal comprises the step of determining said trigonometric function by rotating said Cartesian data of said input digital signal by said previously determined subangle.